CLAIMS

What is claimed is:

1. A tunable laser, comprising:

a gain medium having an active emission layer to generate optical energy, the active emission layer having a first and a second facet;

a first waveguide extending from the first facet, the first waveguide including a first core, the first core having a first end adjacent to the first facet for receiving optical energy, the first core fabricated from inorganic material and the first waveguide including inorganic material and thermo-optical organic material surrounding the first core;

a second waveguide extending from the second facet, the second waveguide including a second core, the second core having a first end adjacent to the second facet for receiving optical energy, the second core fabricated from inorganic material and the second waveguide including inorganic material and thermo-optical organic material surrounding the second core;

a substrate supporting the first waveguide, the second waveguide, and the gain means;

a first reflector positioned to reflect optical energy propagating along the first waveguide if the optical energy has a wavelength that is one of a plurality of first reflection wavelengths;

a second reflector positioned to reflect optical energy propagating along the second waveguide if the optical energy has a wavelength that is one of plurality of second reflection wavelengths;

a thermo-optical organic material positioned to shift the plurality of first and second reflection wavelengths in response to changes of temperature in the thermo-optical organic material; and

a first thermal actuator thermally coupled to change the temperature in the thermo-optical organic material.

2. The tunable laser of claim 1 wherein the first waveguide includes a reflector-free portion interposed between the first end of the first core and the first reflector, the reflector-free portion including a phase control section.

3. The tunable laser of claim 2 further comprising thermo-optical organic material positioned in proximity to the phase control section.

4. The tunable laser of claim 3 wherein the thermo-optical organic material has a coefficient of refractive index variation as a function of temperature, the magnitude of which exceeds 1 x 10^{-4}/°C.

5. The tunable laser of claim 3 wherein the thermo-optical organic material is selected from the group comprising a polymer derived from methacrylate, a polymer

derived from siloxane, a polymer derived from carbonate, a polymer derived from styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

6. The tunable laser of claim 1 wherein the first thermal actuator is selected from the group comprising a resistive heater, a thermoelectric heater, and a thermoelectric cooler.

7. The tunable laser of claim 3 wherein the first thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the phase control section, and further comprising:

a second thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the first reflector; and

a third thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the second reflector.

8. A tunable hybrid laser, comprising:

a substrate fabricated of a first material;

a gain medium fabricated of a second material and mounted onto the substrate, the gain medium including an active emission layer to generate optical energy, the active emission layer having a first and a second facet;

a first waveguide disposed on the substrate and extending from the first facet, the first waveguide including a first core, the first core having a first end adjacent to the first

facet for receiving optical energy, the first core fabricated from inorganic material and the first waveguide including inorganic material and thermo-optical organic material surrounding the first core;

a first reflector positioned to reflect optical energy propagating along the first waveguide if the optical energy has a wavelength that is one of a plurality of first reflection wavelengths;

a second waveguide disposed on the substrate and extending from the second facet, the second waveguide including a second core, the second core having a first end adjacent to the second facet for receiving optical energy, the second core fabricated from inorganic material and the second waveguide including inorganic material and thermo-optical organic material surrounding the second core;

a second reflector positioned to reflect optical energy propagating along the second waveguide if the optical energy has a wavelength that is one of a plurality of second reflection wavelengths;

a thermo-optical organic material positioned to shift the plurality of first and second reflection wavelengths in response to changes of temperature in the thermo-optical organic material; and

a first thermal actuator thermally coupled to change the temperature in the thermo-optical organic material.

9. The tunable hybrid laser of claim 8 wherein the first waveguide includes a reflector-free portion interposed between the first end of the first core and the first reflector, the reflector-free portion including a phase control section.

10. The tunable hybrid laser of claim 9 further comprising thermo-optical organic material positioned in proximity to the phase control sections.

11. The tunable hybrid laser of claim 8 wherein the first thermal actuator is selected from the group comprising a resistive heater, a thermoelectric heater, and a thermoelectric cooler.

12. The tunable hybrid laser of claim 9 wherein the first thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the phase control section, and further comprising:

a second thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the first reflector; and

a third thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the second reflector.

13. The tunable hybrid laser of claim 8 wherein the first material is selected from the group comprising sapphire, gallium arsenide, indium phosphide, silicon, glass, ceramic, and metal.

14. The tunable hybrid laser of claim 8 wherein the second material is selected from the group comprising sapphire, gallium arsenide, and indium phosphide.

15. A tunable laser, comprising:

a gain medium including an active emission layer to generate optical energy, the active emission layer having a facet;

a waveguide extending from the facet, the waveguide including a core, the core having an end adjacent to the facet for receiving optical energy, the core fabricated from inorganic material and the waveguide including inorganic material and thermo-optical organic material surrounding the core;

a substrate supporting the gain medium and the waveguide;

a reflector positioned to reflect optical energy propagating along the waveguide if the optical energy has a wavelength that is one of a plurality of reflection wavelengths;

thermo-optical organic material positioned to shift the plurality of reflection wavelengths in response to changes of temperature in the thermo-optical organic material; and

a first thermal actuator thermally coupled to change the temperature in the thermo-optical organic material.

16. The tunable laser of claim 15 wherein the waveguide includes a reflector-free portion interposed between the end and the reflector, the reflector-free portion including a phase control section.

17. The tunable laser of claim 16 further comprising thermo-optical organic material positioned in proximity to the phase control section.

18. The tunable laser of claim 17 wherein the thermo-optical organic material has a coefficient of refractive index variation as a function of temperature, the magnitude of which exceeds $1 \times 10^{-4}/^{o}C$.

19. The tunable laser of claim 17 wherein the thermo-optical organic material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from a siloxane, a polymer derived from carbonate, a polymer derived from styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

20. The tunable laser of claim 15 wherein the first thermal actuator is selected from the group comprising a resistive heater, a thermoelectric heater, and a thermoelectric cooler.

21. The tunable laser of claim 16 wherein the first thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the phase control section, and further comprising:

a second thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the first reflector; and

a third thermal actuator is coupled to change the temperature in the thermo-optical organic material adjacent to the second reflector.

22. The tunable laser of claim 15 wherein the core further comprise a taper adjacent to the first end for receiving optical energy.

23. An integrated optical component, comprising:

a waveguide disposed on a substrate and including a core having an end for receiving optical energy, the core fabricated from inorganic material and the waveguide including an inorganic material and thermo-optical organic material surrounding the core;

a first reflector positioned to reflect optical energy propagating along the waveguide if the optical energy has a wavelength that is one of a plurality of first reflection wavelengths;

a second reflector positioned to reflect optical energy propagating along the waveguide if the optical energy has a wavelength that is one of plurality of second reflection wavelengths;

thermo-optical organic material positioned to shift the plurality of first and second reflection wavelengths in response to changes of temperature in the thermo-optical organic material; and

a thermal actuator coupled to change the temperature in the thermo-optical organic material.

24. The integrated optical component of claim 23 wherein the waveguide includes a reflector-free portion interposed between the end and the first reflector and between the first reflector and the second reflector, the reflector-free portions including a phase control section.

25. The integrated optical component of claim 24 further comprising thermo-optical organic material positioned in proximity to the phase control sections.